Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Influence of the Metal-MoS_2 interface on MoS_2 Transistor Performance HUI YUAN, Dept of Electrical and Computer Eng, George Mason University, Fairfax, VA, GUANGJUN CHENG, ANGELA HIGHT WALKER, LIN YOU, JOSEPH J. KOPANSKI, Semiconductor and Dimensional Metrology Div, NIST, Gaithersburg, MD, QILIANG LI, Dept of Electrical and Computer Eng, George Mason University, Fairfax, VA, CURT A. RICHTER, Semiconductor and Dimensional Metrology Div, NIST, Gaithersburg, MD — We compare the electrical characteristics of MoS_2 field-effect transistors (FETS) with Ag source/drain contacts with transistors with Ti contacts, and we demonstrate that the metal-MoS_2 interface is crucial to the final device performance. The topography of 5nm Au/5nm Ag (contact layer) and 5nm Au/5nm Ti metal films deposited onto mono- and few-layer MoS_2 was characterized by using scanning electron microscopy and atomic force microscopy. The surface morphology of the Au/Ti films on MoS_2 shows a rough, dewetting pattern while Au/Ag forms smooth, dense films. These smoother and denser Au/Ag contacts lead to improved carrier transport efficiency. FETs with Ag contacts show more than 60 times higher on-state current and a steeper subthreshold slope. Raman spectroscopy of MoS_2 covered with Au/Ag or Au/Ti films revealed that the contact layer is Ag or Ti, respectively. In addition, there is a dramatic difference in the heat transfer between the MoS_2 and the two metals: while laser heating is observed in Au/Ti covered MoS_2, no heating effects are seen in Au/Ag covered MoS_2. It is reasonable to conclude that the smoother and denser Ag contact leads to higher carrier transport efficiency and contributes to the improved thermal properties.

Curt Richter
Semiconductor and Dimensional Metrology Div, NIST, Gaithersburg, MD

Date submitted: 14 Nov 2014 Electronic form version 1.4